Contents lists available atIOCS

Science Midwifery

journal homepage:www.midwifery.iocspublisher.org

The effect of amaranthus tricolor on hemoglobin levels in adolescent girls: Literature reviewe

Dilma'aarij Agustia[1]*, Wiwiek Elsada Nainggolan[2], Ruth Yohana Girsang[3], Novitri Adelina Sipayung[4], Yusmalia Hidayati[5]

[1,2,3,4,5]Midwifery Department, Faculty of Health, Universitas Satya Terra Bhinneka, Medan, Indonesia

ARTICLE INFO

Article history:

Received Apr 22, 2026
Revised May 3, 2026
Accepted May 14, 2026

Keywords:

Adolescent Girls
Amaranthus Tricolor
Anemia
Functional Food
Hemoglobin

ABSTRACT

Iron deficiency anemia remains a major health problem among adolescent girls, often caused by low iron intake and poor absorption. Amaranthus tricolor (red spinach) is a local vegetable known to contain high levels of iron, vitamin C, and antioxidants that support iron absorption. This literature review aimed to analyze the effect of Amaranthus tricolor on hemoglobin levels in adolescent girls. The literature search followed the PRISMA flow using databases such as PubMed, Google Scholar, SpringerLink, and Science Direct for studies published between 2015–2025. Inclusion criteria were full-text articles in Indonesian or English with randomized controlled trial or quasi-experimental designs involving adolescent girls aged 10–18 years. Four studies met the eligibility criteria. Results showed that administration of red spinach extract, tea, or capsule forms significantly increased hemoglobin levels. One study reported, while others demonstrated higher hemoglobin improvements in the intervention group compared to controls receiving Fe tablets ($p < 0.05$). Overall, red spinach effectively improves hemoglobin levels through its iron, vitamin C, and antioxidant content, indicating its potential as a functional food for anemia prevention among adolescents. Further high-quality studies are recommended to determine optimal dosage, form, and duration of intervention.

Corresponding Author:

Dilma'aarij Agustia,
Department of Health,
Universitas Satya Terra Bhinneka,
Jl. Sunggal, Medan Sunggal, Kota Medan, Sumatera Utara, 20128, Indonesia
Email: dilmaagustia@satyaterrabhinneka.ac.id

INTRODUCTION

The most prevalent global public health issue affecting women of reproductive age, especially teenage girls, is iron deficiency anemia. According to the WHO, 30% of women worldwide between the ages of 15 and 49 suffer from anemia (WHO, 2025), Meanwhile, Riskesdas data shows a higher rate in Indonesia, which is around 48.9% in women over the age of 15. Adolescent girls are the most vulnerable group due to menstrual blood loss and increased iron requirements during growth. Anemia can reduce work capacity, cognitive function, endurance, and academic

performance, as well as potentially worsen reproductive health in the future (Sembiring et al., 2021).

One cause of anemia is low iron intake or impaired iron absorption. To address this problem in a sustainable and affordable manner, plant-based sources of nutrients from local vegetables have become the focus of research (Pada et al., 2024). Amaranthus tricolor (red spinach) is one vegetable that has traditionally been used in communities and has been reported to have a high mineral content, especially iron, as well as components that support iron absorption, such as vitamin C and antioxidant compounds (Orsango et al., 2020). Red spinach is known to be rich in iron, vitamin C, and antioxidants that support iron absorption. Studies report an average iron content of 1,233.8 mg/kg dry weight in A. tricolor (Shukla, S., Bhargava, A., Chatterjee, 2016), and increasing the nutrient content through specific cultivation practices (Sarker et al., 2019). Therefore, A. tricolor has the potential to be developed as a local food source rich in micronutrients to help prevent anemia, especially in adolescent girls (Sarker et al., 2024).

Various intervention studies, both clinical trials and field studies, have assessed the effect of consuming amaranth-based products on hemoglobin levels and anemia prevalence, but the results are still mixed. Several studies report that providing amaranth-based processed foods, such as bread or flatbread, can increase hemoglobin levels and reduce anemia rates in children (Alemselam Zebdewos Orsango, et al, 2020). Other studies using extracts or juice from Amaranthus tricolor (red amaranth) have also shown an increase in hemoglobin levels in certain groups (Resty Himma Muliani, et al, 2020). However, recent systematic reviews highlight inconsistent results between studies, with variations in dosage, duration, dosage form, and subject characteristics, necessitating further studies with stronger methodological designs and quality to obtain definitive conclusions (Yilma et al., 2024).

Red spinach preparations or juice can raise hemoglobin levels in a variety of populations, according to several experimental and clinical investigations conducted in Indonesia (Sitepu, 2022). For instance, a study of first-trimester pregnant women who received red spinach leaf juice found that their hemoglobin levels significantly increased after the intervention (In et al., 2019). Quasi-experimental studies on postpartum mothers also found that Amaranthus tricolor extract effectively increased hemoglobin within 14 days (Ginting et al., 2021). Then, a combination intervention of blood-boosting tablets and red spinach tea in teenage females revealed that the intervention group had higher levels of Hb and other blood parameters than the control group. However, the results of these studies still vary in terms of duration, dosage, method of administration (extract, juice, tea, processed food), and subject groups. There hasn't been a thorough data synthesis using a particular meta-analysis in teenage girls to determine how much Amaranthus tricolor extract affects hemoglobin levels in this situation (Wilandri et al., 2023). Previous research has shown that Amaranthus tricolor can increase hemoglobin levels in adolescent girls, pregnant women, and postpartum women; however, there are still some gaps in the findings regarding variations in results. This is because the studies used small sample sizes and short intervention durations; therefore, a literature review is necessary to determine the optimal intervention duration and sample size to ensure more effective results.

Amaranthemia tricolor is crucial for preventing anemia in adolescent girls (Purba et al., 2025)(Rahmawati, 2025)(Afifatussholihah & Nafies, 2025). The high prevalence of anemia among adolescent girls remains high, impacting their learning ability, endurance, and future reproductive health (Maigoda, 2025)(Salsadela, 2025). The use of local foods is also more economical, readily available, and culturally appropriate, making this utilization not only a sustainable solution but also a way to address the prevalence of anemia in adolescent girls.

Because of this, studies on how Amaranthus tricolor affects hemoglobin levels continue to vary widely in terms of time, dosage, dosage type (extract, juice, tea, or processed food), and participant characteristics. To date, there has been no meta-analysis that comprehensively assesses the effects of this plant on adolescent girls. Therefore, this study aims to synthesize existing

empirical evidence to estimate the average effect of A. tricolor-based interventions, identify moderating factors such as dosage, duration of administration, initial anemia status, and dosage form, and assess the quality of evidence and its implications for the development of local nutrition programs in the prevention of anemia in adolescents.

RESEARCH METHOD

Study Design

This study used a literature review as its study design. The PRISMA flow chart guidelines are used in this investigation. The PubMed, Google Scholar, SpringerLink, and Science Direct databases were searched for articles. The articles used in this study were those published between 2015 and 2025. The keywords used in the article search were "Red Spinach" OR "Amaranthus tricolor" AND Hemoglobin OR Anemia AND Adolescent Girls.

Inclusion Criteria

Adolescent females between the ages of 10 and 18 served as the study's research subjects, and full-text publications with a randomized controlled trial (RCT) and quasi-experimental design met the inclusion requirements, and the intervention given was the administration of red amaranth (Amaranthus tricolor) in comparison with other amaranth varieties. Hemoglobin levels were assessed using standard measuring instruments, and the articles used in this study were published in English or Indonesian.

Exclusion Criteria

Exclusion criteria were adolescents aged > 18 years, and interventions that did not use red spinach preparations.

Operational Definition of Variables Problem Formulation with PICO

The PICO model-established eligibility criteria were taken into consideration when searching for articles. Teenage girls between the ages of 10 and 18 made up the study's population. The intervention was red amaranth (Amaranthus tricolor) preparation. The comparison was made with non-red amaranth. The results were hemoglobin levels or anemia levels. The administration of red amaranth (Amaranthus tricolor) was the administration of red amaranth without any additives. Hemoglobin levels were the amount of increase in hemoglobin levels that did not indicate anemia.

Article Data Analysis

Data Analysis Using the PRISMA flow diagram standards, articles were gathered and subjected to a literature review analysis. The critical appraisal was conducted using the Joanna Briggs Institute (JBI) methodology. All selected studies were systematically evaluated for methodological quality, validity, and risk of bias using the appropriate JBI critical appraisal tools. This process ensures that only studies meeting the established quality standards are included in the analysis, thereby enhancing the reliability and credibility of the findings.

RESULTS AND DISCUSSIONS

Figure 2 illustrates how to search for articles using the journal database. Four papers satisfied the requirements for examining the impact of processing amaranthus tricolor on hemoglobin levels in teenage girls, according to the final results of the article review procedure.

In the article search, a total of 143 articles were found from four existing databases. After duplicates were removed, there were 6 articles. Next, 106 articles were excluded because the titles were not relevant, there was no full text, and they were not in English or Indonesian. A further screening was conducted, and 27 articles were excluded because the sample or population was not

adolescent girls but pregnant women, and the outcome was not anemia or hemoglobin levels. Thus, there were 4 articles that passed for qualitative analysis (Figure 1).

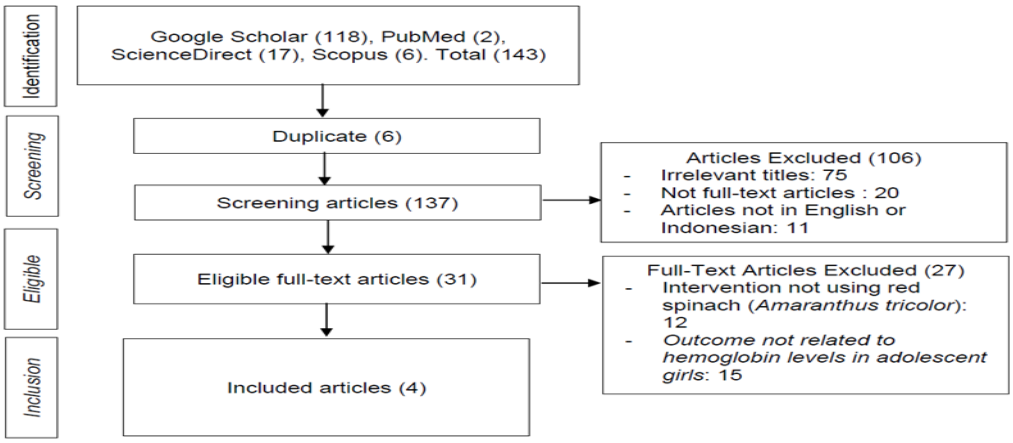

Figure 1. PRISMA Flow Diagram

Table 1. Research summary on the effect of amaranthus tricolor on hemoglobin levels in adolescent girls: literature review

Title	Author	Year / Country	Study Design	Total Samples	Population	Intervention	Comparison	Outcome
Substitution of Red Amaranth Flour (Amaranthus tricolor L.) in Manufacture Wet Noodles as Foods High in Iron (Fe)	Hikmathine Osella Putri, Syafran Arrazy, Wahyudi	2024 / Indonesia	Experimental study using a Completely Randomized Design (CRD) with three treatment groups.	25	Students from the Faculty of Public Health, Universitas Islam Negeri Sumatera Utara (UINSU).	Wet noodles made with substitution of red amaranth (*Amaranthus tricolor*) - 0% (Control – F1) - 25% (F2) - 50% (F3)	Control group (F1) without red amaranth flour. Compared with F2 and F3 groups containing 25% and 50% red amaranth flour respectively.	Substitution of *Amaranthus tricolor* flour in wet noodles significantly increased iron content, especially at 50% substitution, but higher substitution levels reduced sensory acceptability among panelists.
Effect of Red Spinach Extract (*Amaranthus tricolor* L) Allotment to Increase Haemoglobin Levels of Politekkes First Year Students in Medan	Arihta Br. Sembiring, Novita Andriani Br. Manjorang, Rosianna Br. Sembiring	2021 / Indonesia	Quasi-experimental design with pre- and post-test group design	84 female respondents	First-year midwifery students at the Medan Health Polytechnic (Poltekkes Kemenkes Medan) who were anemic	Consumption of red spinach (*Amaranthus tricolor* L) extract capsules (260 mg) once daily for 30 days	Hemoglobin (Hb) levels before and after administration of red spinach extract (no separate control group)	Primary outcome: Hemoglobin level (g/dL) Before intervention: Mean Hb = 11.955 g/dL After intervention: Mean Hb = 12.404 g/dL Statistical result: Significant increase in Hb levels (p = 0.002, paired t-test)

Effectiveness of Giving Red Spinach Leaf Capsules to Adolescent Girls on Hemoglobin Levels, Kendari City, Indonesia	Sultina Sarita, Heyrani Heyrani, Hesti Resyana	2025 / Indonesia	Randomized pretest-posttest controlled design (Quasi-experimental study)	160 adolescent female students	Female students aged 15–17 years from three senior high schools (Soropia, Sampara, and Morosi) in Kendari City, Indonesia	Administration of red spinach (*Amaranthus tricolor* L.) leaf capsules, 2 capsules per day for 60 days	Fe (iron) tablets group (control) vs. red spinach leaf capsule group (intervention)	Red spinach leaf capsules significantly increased hemoglobin levels in adolescent girls compared to Fe tablets. The capsules, rich in iron (91.72 mg/100 g), vitamin C, and other micronutrients, were effective in combating anemia and are recommended as a natural dietary supplement to improve hemoglobin status among adolescents.
The Effect of Red Spinach Tea (*Amaranthus tricolor* L.) on Blood Profile in Adolescent Girls with Anemia	Ni Wayan Darmayanti, I Ketut Sukerayasa, Ni Nyoman Purnama Dewi	2024 / Indonesia	True experimental design — *Pretest–Posttest Control Group Design*	40 respondents (20 intervention, 20 control)	Adolescent girls aged 17–19 years diagnosed with mild anemia in Denpasar, Bali	Consumption of red spinach (*Amaranthus tricolor* L.) tea twice daily (morning and evening) for 14 days, alongside standard iron supplementation	Control group received only iron tablets (Fe) without red spinach tea	Red spinach tea (*Amaranthus tricolor* L.) effectively increased hemoglobin, erythrocyte count, and hematocrit levels among adolescent girls with anemia. The results demonstrate that natural plant-based interventions can be a complementary approach to prevent and treat anemia in adolescents. Hemoglobin (Hb) levels: Increased significantly in the intervention group compared to control ($p < 0.05$) Erythrocyte count: Significant improvement in the red spinach tea group ($p < 0.05$) Hematocrit value: Also increased significantly after intervention ($p < 0.05$)
Effect of Consuming Red Spinach (*Amaranthus tricolor* L.) Extract on	Ayu Hilda Ramadhani, Anni Isnawati, Lely	2017 / Indonesia	Quasi-experimental design with *pretest–posttest control group*	30 respondents (15 intervention group, 15	Postpartum mothers with mild anemia in the working	Consumption of red spinach (*Amaranthus tricolor* L.) extract 250 ml/day	Control group received Fe tablets only, while the intervention group received Fe	Supplementation with red spinach extract alongside Fe tablets significantly improved hemoglobin levels in postpartum mothers. The results

Hemoglobin Levels in Postpartum Mothers	Wahyuniar		control group)	area of Sumbersari Public Health Center, Jember, Indonesia	for 14 days	tablets + red spinach extract	support red spinach (*Amaranthus tricolor* L.) as a natural source of iron that can enhance anemia management during the postpartum period. Hemoglobin levels: Increased significantly in the intervention group compared to control (p = 0.000) Mean Hb increase: 1.63 g/dL (intervention) vs 0.67 g/dL (control). Effectiveness: Red spinach extract demonstrated greater improvement in Hb levels among postpartum mothers with anemia.

Red spinach processed into food additives and extracts can considerably raise hemoglobin levels in teenage females, which can influence the diagnosis of low anemia, according to the analysis of the papers.

Research by Putri et al. (2024) shows that substituting red spinach flour in the production of wet noodles significantly increases iron content, especially at a 50% substitution rate, although sensory evaluation decreases at high substitution rates. Meanwhile, research by Sembiring et al. (2021) reported that administering 260 mg of red spinach extract capsules per day for 30 days significantly increased hemoglobin levels from 11.955 g/dL to 12.404 g/dL (p = 0.002).

The study by Sarita et al. (2025), which used a quasi-experimental design, showed that administering red spinach leaf capsules twice daily for 60 days was superior to Fe pills in raising hemoglobin levels in teenage girls. The amount of iron (91.72 mg/100 g) and vitamin C in red spinach capsules contributed to this increase. Additionally, a study by Darmayanti et al. (2024) reported that consuming red spinach tea twice daily for 14 days significantly increased hemoglobin levels, erythrocyte count, and hematocrit values in adolescent girls with mild anemia ($p < 0.05$). Meanwhile, a study by Ramadhani et al. (2017) found that the combination of red amaranth extract and iron tablets increased hemoglobin levels in postpartum women by an average of 1.63 g/dL, higher than the control group, which was only 0.67 g/dL (p = 0.000).

Overall, the review's findings show that Amaranthus tricolor preparations' iron, vitamin C, and antioxidant chemical content, which promotes iron absorption, have a considerable potential to raise hemoglobin levels in a variety of populations, particularly teenage girls. Red amaranth (Amaranthus tricolor L.) contains iron, folate, and vitamin C, which help the body produce hemoglobin and absorb more non-heme iron (Sarita et al., 2025; Tita Hardianti, et al, 2026). The availability of processed red spinach can be an alternative functional food that is easily accepted and liked by teenagers, making it effective for use in anemia prevention efforts (Sembiring et al., 2021). Training on processing red spinach to prevent anemia and stunting (Hariyani Putri et al., 2021). In addition, the findings revealed that the main factors causing discrepancies in results among previous studies were variations in the dosage of Amaranthus tricolor, the duration of administration, and the dosage form, due to the availability of different formulations such as juice,

extract, and vegetables. Furthermore, differences in the characteristics of the participants' responses and their adherence to consuming Amaranthus tricolor also contributed to these discrepancies in results. Another study mentions that there are different measurement schemes or methods used to determine hemoglobin levels.

According to the review's findings, Amaranthus tricolor contains vital minerals like iron, vitamin C, and antioxidants that help raise hemoglobin levels (Pangan et al., 2019). These components help with the absorption of non-heme iron and support the process of erythrocyte formation, thereby increasing the body's oxygen-carrying capacity. Several studies reviewed consistently show a significant increase in hemoglobin levels after administration of Amaranthus tricolor in various forms, such as extracts, tea, and capsules (Dewi Sartika Siagian, 2023). Differences in results between studies are likely influenced by variations in dosage, duration of intervention, and dosage form used. However, in general, the available evidence shows that Amaranthus tricolor is effective in increasing hemoglobin levels in adolescent girls. These results lend support to the use of Amaranthus tricolor as a functional food in anemia prevention initiatives, particularly in regions that depend on locally accessible and reasonably priced sources of plant-based micronutrients (Sembiring et al., 2021). Further research with higher methodological quality is needed to determine the optimal dosage, dosage form, and long-term effects on hemoglobin and iron status (Give et al., 2017). The implementation of Amaranthus Tricolor as a functional food has important practical implications, particularly for reproductive health and community nutrition. This plant is readily accessible and can increase hemoglobin levels and prevent anemia in adolescent girls. Its rich content of iron, folate, vitamin C, and antioxidants supports blood formation and overall health without relying solely on supplements. Furthermore, this plant is offered frozen for serving because it can be processed into various forms, such as juice and extract, allowing for a variety of preparations. This was due to the dosage and frequency of administration, the duration of the intervention, the form of preparation (e.g., extract or processed food), the initial level of anemia, and the daily consumption and dietary patterns of the respondents (Siti Patimah, Femy Rahmandari, 2025).

Amaranthus tricolor is a potential functional food for improving hemoglobin status in adolescent girls (Nasution et al., 2021). In addition to being easily accessible, red amaranth is an affordable local plant-based food that can be cultivated by the community and has a good nutritional profile. However, variations between studies indicate the need for further research with stronger experimental designs, such as high-standard RCTs, as well as determining the optimal dosage, duration, most effective dosage form, and long-term safety of use. Further studies are also needed to explore the use of red amaranth in mass intervention programs such as UKS, Puskesmas, and community empowerment (Afifatussholihah et al., 2025; Jaya et al., 2020).

CONCLUSION

Various forms of red spinach preparations can increase hemoglobin levels through their iron, vitamin C, and antioxidant content, which support the formation and absorption of hemoglobin, thereby contributing to the improvement of anemia in adolescent girls. These findings indicate that Amarantus tricolor has the potential to be used as a functional food in anemia prevention efforts, Even so, more investigation is required to ascertain the optimal dosage, type, and length of intervention, also strengthen the foundation for developing sustainable, context-specific community-based nutrition interventions that do not rely on commercial supplements. Further research should include randomized controlled trials (RCTs) to generate more valid evidence that can serve as a guide.

ACKNOWLEDGEMENTS

The database providers of PubMed, Google Scholar, and Science Direct have our sincere gratitudes.

References

Afifatussholihah, F., Ayu, D., & Nafies, A. (2025). Efek Pemberian Jus Bayam Merah Terhadap Peningkatan Kadar Hemoglobin Remaja Putri di MA Plus Sunan Drajat 7 Kecamatan Palang tricolor L . (bayam merah). Analisis komposisi gizi mengungkapkan bahwa setiap 100 gram. *Jurnal Riset Ilmu Kesehatan Umum Dan Farmasi*, *4*(September), 212–222.

Afifatussholihah, F., & Nafies, D. A. A. (2025). Efek Pemberian Jus Bayam Merah Terhadap Peningkatan Kadar Hemoglobin Remaja Putri di MA Plus Sunan Drajat 7 Kecamatan Palang. *Jurnal Riset Ilmu Kesehatan Umum Dan Farmasi (JRIKUF)*, *3*(4), 212–222.

Alemselam Zebdewos Orsango, Eskindir Loha, Bernt Lindtjørn, I. M. S. E. (2020). Efficacy of processed amaranth-containing bread compared to maize bread on hemoglobin, anemia and iron deficiency anemia prevalence among two-to-five year-old anemic children in Southern Ethiopia: A cluster randomized controlled trial. *PLoS One*, *19*(9). https://doi.org/https://doi.org/10.1371/journal.pone.0239192

Ginting, K. A., Panjaitan, R., & Cholilullah, A. B. (2021). Pengaruh Pemberian Jus Bayam Merah (Amaranthus Gangeticus) Terhadap Peningkatan Kadar Hemoglobin Pada Ibu Hamil Penderita Anemia. *Jurnal Kesehatan Masyarakat & Gizi*, *3*(2), 202–206.

In, P., Girls, A., & Anemia, W. (2019). Indonesian Journal of Global Health Research. *Indonesian Journal of Global Health Research*, *2*(4), 327–334. https://doi.org/10.37287/ijghr.v2i4.250

Jaya, N., Sary, L., & Putri, R. D. (2020). Manfaat bayam merah (amaranthus gangeticus) untuk meningkatkan kadar hemoglobin pada ibu hamil. *Jurnal Kebidanan*, *6*(1), 1–7.

Maigoda, T. C. (2025). *Anemia Gizi Remaja Putri: Dampak, Penyebab, dan Solusi Berbasis Bukti*. Penerbit NEM.

Nasution, R. S., Aisyah, S., & Harahap, H. P. (2021). Konsumsi jus bayam merah dapat meningkatkan kadar hemoglobin pada ibu hamil trimester ii. *Jurnal Kebidanan Malahayati*, *7*(2), 215–221.

Orsango, A. Z., Loha, E., Lindtjørn, B., & Engebretsen, I. M. S. (2020). Efficacy of processed amaranth-containing bread compared to maize bread on hemoglobin, anemia and iron deficiency anemia prevalence among two-to-five year-old anemic children in Southern Ethiopia: A cluster randomized controlled trial. *PLoS ONE*, *15*(9 September), 1–16. https://doi.org/10.1371/journal.pone.0239192

Pada, H., Putri, R., & Anemia, D. (2024). Efektifitas Pemberian Puding Bayam Merah Terhadap Kadar Hemoglobin Pada Remaja Putri Dengan Anemia. *Journal of Nursing Sciences)*, *13*(6), 42–50.

Purba, B. A. C., Keb, M. T., & Sumarni, S. (2025). *TEH BAYAM MERAH (AMARANTHUS TRICOLOR L): Sebagai Terapi Alternatif Pendamping Tablet Tambah Darah Untuk Pencegahan Dan Penanganan Anemia Pada Remaja Puteri*. Penerbit KBM Indonesia.

Rahmawati, N. (2025). *PENGARUH EKSTRAK BAYAM MERAH (Amaranthus tricolor L.) TERHADAP KADAR HEMOGLOBIN (Studi Eksperimental Pada Ibu Hamil dengan Anemia Trimester II-III di Wilayah Kerja Puskesmas Mancak Kab. Serang Banten Tahun 2024)*. Universitas Islam Sultan Agung Semarang.

Resty Himma Muliani*, Ariawan Soejoenoes, Titi Suherni, Soeharyo Hadisaputro, I. D. M., & Magister. (2020). *Effect of Consuming Red Spinach (Amaranthus Tricolor L) Extract on Hemoglobin Level in*. *3*(4), 432–437.

Salsadela, N. E. (2025). *HUBUNGAN POLA MAKAN DAN STATUS GIZI DENGAN KEJADIAN ANEMIA PADA REMAJA PUTRI KELAS XI DI SMA N 7 YOGYAKARTA*. Poltekkes Kemenkes Yogyakarta.

Sarker, U., Islam, M. T., & Oba, S. (2019). Salinity stress accelerates nutrients, dietary fiber, minerals, phytochemicals and antioxidant activity in Amaranthus tricolor leaves. *PLoS ONE*, *13*(11), 1–18. https://doi.org/10.1371/journal.pone.0206388

Sarker, U., Oba, S., Ullah, R., Bari, A., Ercisli, S., Skrovankova, S., Adamkova, A., Zvonkova, M., & Mlcek, J. (2024). Nutritional and bioactive properties and antioxidant potential of Amaranthus tricolor, A. lividus, A viridis, and A. spinosus leafy vegetables. *Heliyon*, *10*(9), e30453. https://doi.org/10.1016/j.heliyon.2024.e30453

Sembiring, A. B., Andriani, N., Manjorang, B. R., & Sembiring, R. B. (2021). Effect Of Red Spinach Extract (Amaranthus Tricolor L) Allotment To Increase Haemoglobin Levels Of Politekkes First Year Students In Medan. *Journal of Medicine and Health Research*, *6*(2), 24–34.

Shukla, S., Bhargava, A., Chatterjee, A. et al. (2016). Mineral Profile and Variability in Vegetable Amaranth (Amaranthus tricolor). *Plant Foods Hum Nutr*, *61*(5), 21–26. https://doi.org/https://doi.org/10.1007/s11130-006-0004-x

Sitepu, S. A. (2022). Pengaruh Pemberian Rebusan Bayam Merah Terhadap Peningkatan Kadar Hb Pada Ibu Hamil Trimester Ii Dengan Anemia Di Klinik Kurnia Deli Tua Tahun 2022. *Jurnal Penelitian Kebidanan & Kespro*, *5*(1), 43–50.

Siti Patimah, Femy Rahmandari, H. K. (2025). Perbandingan Pemberian Jus Bayam Merah Dan Jus Bayam Hijau Terhadap Kadar Hb Pada Remaja Putri Siti. *Jurnal Bidan Komunitas*, *5*(1), 23–31.

WHO. (2025). *Anaemia*. WHO.

Wilandri, G. L., Kusumawardani, N., Viray, D. T., & Aprilia, V. (2023). Red spinach-containing snack food improved hemoglobin and hematocrit levels of girl adolescents in Riau Archipelago. *Indonesian Journal of Nutrition and Dietetics*, *11*(3), 152–159.

Yilma, M. T., Eifa, A., Belayneh, M., & Orsango, A. Z. (2024). Effect of Amaranth-Containing Dietary Intervention in Improving Hemoglobin Concentration: A Systematic Review and Meta-Analysis. *Public Health Reviews*, *45*(January), 1–10. https://doi.org/10.3389/phrs.2024.1607597